Directions:

The Celestial Sphere – Questionnaire

(After reading the material about the celestial sphere, answer the following)

1) What is the "celestial sphere" and why do we use it?

2) Are the positions of the stars on the celestial sphere fixed with respect to each other?

3) At night, how do stars appear to move, and why? What else moves in this manner besides the stars?

4) How long does it take the Earth to make a full rotation around this axis relative to the Sun? What about relative to distant stars?

5) If the Earth's rotation causes the Sun to set in the West, towards what direction must we be rotating?

6) When viewed from above the North Pole, does the Earth rotate clockwise or counterclockwise? (Try to picture this on a globe.) What about when viewed from above the South Pole?

7) What makes Polaris unique? Will Polaris always be such an important star? Why or why not?

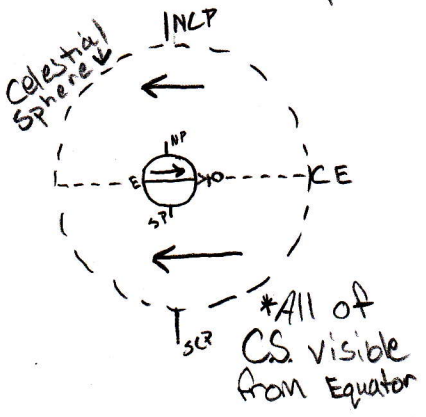
8) Is Polaris special anywhere else besides on Earth? Why, or why not?

9) Do all stars rise and set? Explain your answer.

10) Can any star visible from Earth be seen from the USA? Explain.

11) Explain, using drawings, what parts of the celestial sphere (if any) are *never* visible from:

a. the Equator(example) **b.** the North Pole **c.** Quakertown, PA



12) What are the names of the gridlines we use to plot the positions of stars on the celestial sphere?

13. Astronomers will often describe features on the Celestial Sphere with the word "celestial". For example, the extension of the North Pole to the sky is called the *North Celestial Pole* (or *NCP*).

Celestial Sphere term	Earth-based term
Right Ascension	
Declination	
Celestial Equator	
North Celestial Pole	
South Celestial Pole	

14. Identify the four Cardinal Points for any observer on Earth. (4 directions)

15. Explain how you could determine which way was South just by watching the sky. (There are a few ways to do this)

16. Imagine that you observe Polaris straight overhead. Where are you on Earth? Describe the movement of the stars relative to the horizon as the Earth rotates.

17. Imagine that you observe Polaris on the North point of the horizon. Where are you on Earth? Describe the movement of the stars relative to the horizon as the Earth rotates.

18. Could you observe Polaris from a latitude of 23.5°S? Explain.

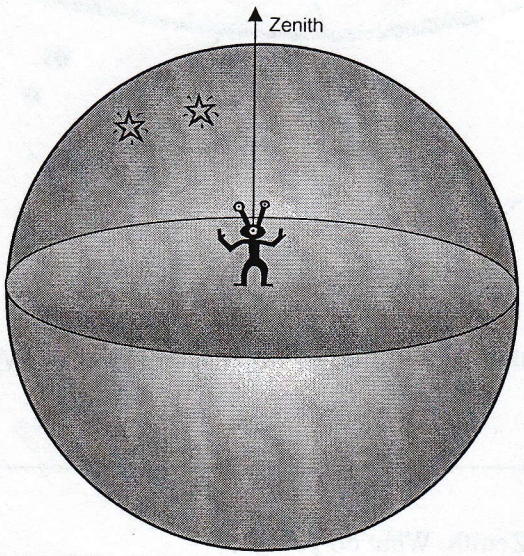
19. Typically, your fist at arm's length represents roughly 10° in the sky. Imagine that you observe Polaris and measure it to be about 4 fists above the northern horizon. What latitude are you at on Earth?

THE APPARENT MOTION OF STARS IN THE SKY

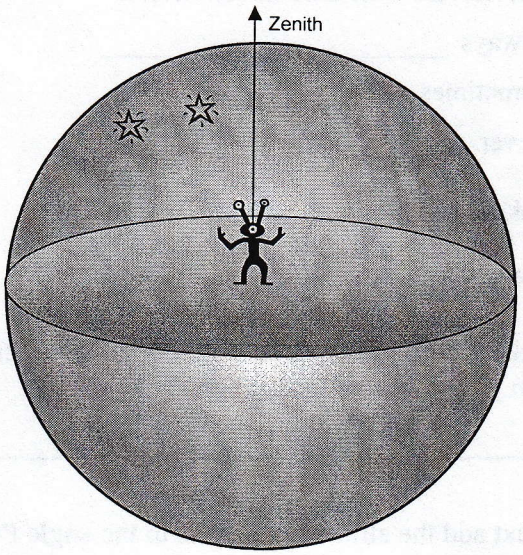
With the aid of the celestial sphere figure out what the night sky looks like, where the North Pole is relative to your location on Earth, and how the stars appear to move throughout the sky. Use the Celestial Sphere as in Part II, but rotate the Sphere around its axis. This will show you the motion of the stars; where they rise, where they transit (when they are at their highest point), and where they set.

For **EACH** of the four diagrams below, draw the following:

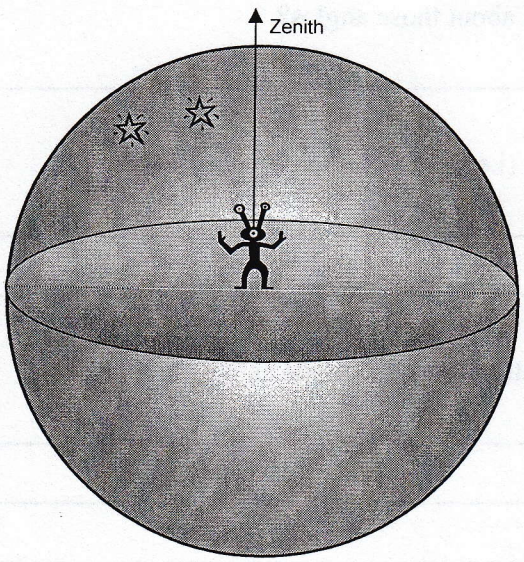
a) Using a black pen label the **HORIZON**, and N, S, E, W **on** the **HORIZON**
b) Using a blue pen label **POLARIS**, the **N-S AXIS**, the **CELESTIAL EQUATOR**
c) Using a red pen label your **LATITUDE** and the **ALTITUDE** of **POLARIS**
d) Using a green pen draw the paths of the **two** stars in **ALL FOUR** diagrams



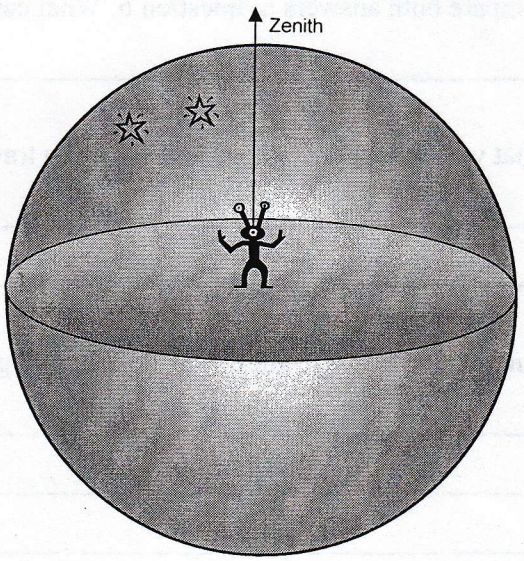
North Pole / 90°



Oslo / 60°



Washington / 30°



Equator / 0°

1) Label the following quantities: the **NORTH** and **SOUTH CELESTIAL POLES**; your **HORIZON**; your **ZENITH**; your **N, S, E, W**; the **MERIDIAN**; and the **CELESTIAL EQUATOR**.

2) Draw the paths of the five stars in the diagram. Also draw arrows showing the direction of motion.

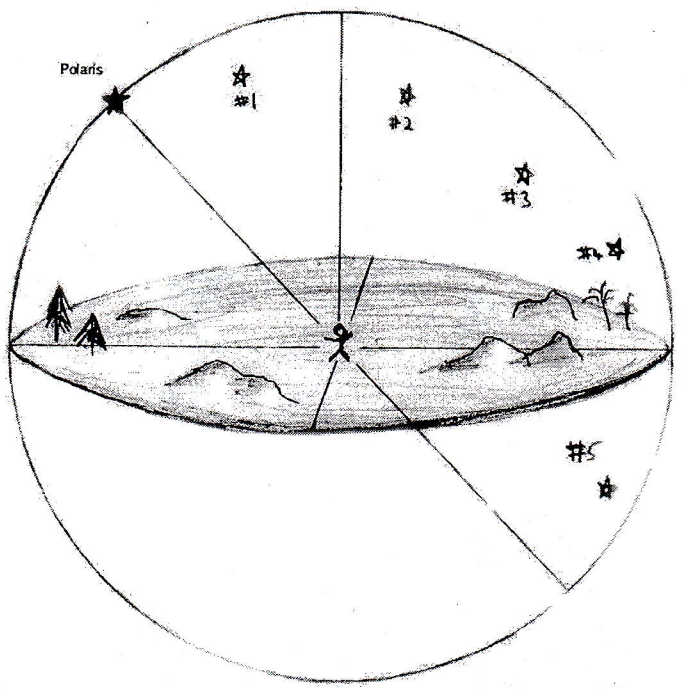
3) Indicate which stars are always visible, which stars are sometimes visible, and which are never visible.

   Always _____

   Sometimes _____

   Never _____

4) Take a red pen and draw the altitude of Polaris (an angle). Then draw the latitude of the observer in the picture.



5) Take blue pen and draw angle Polaris-to-Zenith and the angle Celestial Equator-to-Horizon. What can you say about those angles?

_____

6) Next add the altitude of Polaris to the angle Polaris-to-Zenith. What do you get? _____

   Then add your Latitude to the angle Polaris-to-Zenith. What do you get? _____

7) Compare both answers of question 6. What can you say about those angles?

_____

8) What would happen to those angles as you travel North (i.e., as you increase your latitude?)

_____

_____

9) Comment on how the altitude of Polaris changes in relation to your latitude as you travel North.

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